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RAMP SERVICES AND SAFETY DOCKING SYSTEM

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Summary. The article specifies the safety system at the aerodrome traffic area. It deals with the safety of movement and especially with the system of automatic guidance of aircraft on the stand. Individual systems use laser scanning methods, photo-optical and video scanning methods. These help to maintain a high degree of movement safety on apron while speeding up the process at ramp service.

Keywords: technical dandling, ramp service, visual docking guidance system, laser and video sensors

1. INTRODUTION

Ramp service is characterized by a wide range of services provided at airports to support air traffic. Specific activities such as baggage loading and unloading, passengers boarding, de-icing and anti-icing of aircraft, power supply, aircraft filling with special gases and fuel. The main requirement of aircraft ground handling is speed, efficiency, and accuracy. Emphasis is placed on minimizing the duration of the aircraft on the apron. This is due to a number of organizational and management measures, but mainly to the technical provision of these activities. Today's airport operations are expected to do more with less, meet current demands, plan for the future and always remain flexible. Adding to the challenges faced by airport and airline operators, global traffic is predicted to increase by about 5% each year until 2025, according to the ICAO. Advanced Visual Docking Guidance System technology has the capability to link all gates via a local area network and integrate with all airport and airline information systems, providing the fastest time from touch-down to gate and real-time gate intelligence and shared flight data that can be used to make improvements to many aspects of airfield operations. The systems can also be used to capture and report actual in and out times and that information is automatically sent to operations for tracking/analyzing gate utilization and accurate billing. Turn times can be tracked by city pairs, gate, crew or time of day [1].

2. IMPORTANCE OF AIRCRAFT GUIDANCE TO THE STAND

It is one of the activities on the movement areas of the airports, where the tasks of their guidance to the stand are filled with the emphasis on the safety of aircraft movement. Direct aircraft guidance is carried out mainly at high density of ground movement of aircraft, small pilot experience with movement at the airport and especially at bad weather. At this time, Follow Me cars play an important role at airports. They speed up the safe operation and movement of aircraft over the surface.

The process of guiding the aircraft begins before the aircraft lands, when the pilot receives instructions from the control tower about the way of rolling and the rack on the tripping area. After rolling out the aircraft from Runway, it is gradually guided to the appropriate stand. The guidance and movement method is determined by the controller in conjunction with the airport dispatcher. It's easier with open-stand stands where the plane can in-roll and out-roll itself. For Nose-in stands (terminal buildings and boarding bridges), the guidance process is more complex, whether for Marshallers who need to guide the aircraft to within a few centimeters, or for technical guidance. Proper placement of the aircraft is important from several factors - alignment with boarding bridges and to ensure safe technical handling [2].

3. METHOD OF GUIDANCE TO THE STAND USING VISUAL GUIDANCE SYSTEMS

The systems are used as a digital aid to assist pilots in accurately guiding the aircraft to the stand. The Visual Docking Guidance System (VDGS) has a scanning device to identify the aircraft and, after identification, guide the aircraft to the correct stop point. To ensure maximum safety, the individual systems work with the initial information - the scanned position of the boarding bridge to prevent damage to either the bridge or the aircraft. Some international airports use more than 8 central control systems. After the aircraft is scanned, the image parameters are checked along with the data obtained from the database. Subsequently, the aircraft is guided to the accurate parking of the nose-wheel at the marked location and helped to track the parking line, which is marked with horizontal marking. If the data does not match, the message IP FAILED appears on the display. If the aircraft deviates from the optimum path, the arrows on the display unit of the device are routed and the distance to the parking space is also displayed [3].

3.1. Azimuth Guide AGNIS and Parallax Aircraft Parking Aid

The sophisticated Azimuth Guidance for Nose-In Stands system has two vertical, parallel light bars. Both appear green when the aircraft is on the stand centreline but, if it is displaced to the left or right, the light on that side turns red, inviting the pilot to turn towards the green light to regain the centreline. It was first introduced at London Heathrow Airport.

AGNIS provides a way to guide the aircraft through axis alignment and is commonly used in conjunction with the PAPA system and signal boards, lines or mirrors. The system is used from the left pilot position, where the pilot follows two vertical light signals consisting of red and green. Two green colors indicate correct alignment. If the left side is red and the right side is green, the pilot must guide the plane so that the left side goes from red to green and vice versa [4].

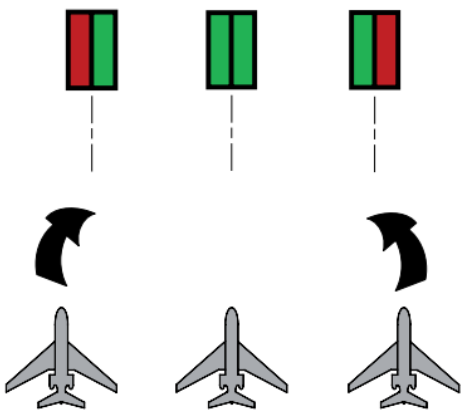

Figure 1 System AGNIS

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A simple but more accurate system is the Side Marker Board. This board is positioned so that it is alongside the flight deck, the aircraft should be stopped when the marker appropriate to the aircraft type is abeam the pilot. With care, this may be used from either seat, and monitoring is possible. PAPA (Parallax Aircraft Parking Aid) has a horizontally slotted black marker board mounted to one side of the head of the stand. Behind the marker board, a vertically oriented white fluorescent light shines through the slot and appears to traverse the slot as the aircraft moves forward. Marks on the board identify the correct alignment of the light according to aircraft type. Generally the alignment between the illuminated light and the marks on the board is not perpendicular to the stand centerline so the system can only be used from the LHS and accurate monitoring is not possible. Any lateral displacement from the stand centerline will cause an incorrect stopping position indication.

3.2. Position and information system of APIS ++

The Aircraft Positioning and Information System APIS ++ is designed to be used by a pilot sitting in the left pilot position and combines the alignment and display of the signals shown on the display at the height of the pilot's eyes. Display elements include an alphanumeric yellow dot matrix element displayed at the top and a dot strip shown at the lower left side that indicates the unit of progress of the aircraft for the last movement performed to reach the stop position.

Figure 2 APIS++ from FMT

Measurement of speed and distance with profile recognition is performed by a high precision laser. The text is shown on the LED boards providing distance information in different colors defined by ICAO. Profile Scanning FMT has developed an aircraft recognition system by type. It is a technology with which it is possible to identify an aircraft with 100% certainty. Each aircraft has a 24-bit ICAO code that is recognized by the APIS and shows what type of aircraft it is, what its flight number, the airline, its number, and so on. If the aircraft approaches the bad stand, the system will alert the pilot with a STOP signal and alert the central control center. The boarding bridges are blocked until the aircraft is parked in the correct position. At the request of airlines and airport operators, FMT has developed advanced airport resource detection. Obstacle detection is performed using three dimensional cameras that are set and calibrated to identify small objects in the defined area of standing [5, 6].

3.3. Honeywell's Advanced Visual Docking Guidance System

It represents the latest visual guidance system on the stand. It uses video technology and a dynamic-distance video sensor that reveals incoming airplanes with high-quality aircraft rendering images. With video technology, the dynamic range detector detects an incoming aircraft with a high-capacity image processing unit that is compared to a comprehensive 3D aircraft model database. The dock driver then converts the processed data to accurate navigation information and displays it on the Pilot Display Unit (PDU) so that pilots can safely scroll and land the aircraft

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on a STOP line for that aircraft type. All installed A-VDGS units can be controlled and monitored by a central computer, which processes individual docking positions and communicates with other aerodrome systems. In addition, camcorders provide information about the situation and allow the recording, archiving and playback of docking sequences on the apron of the service ramp [7].

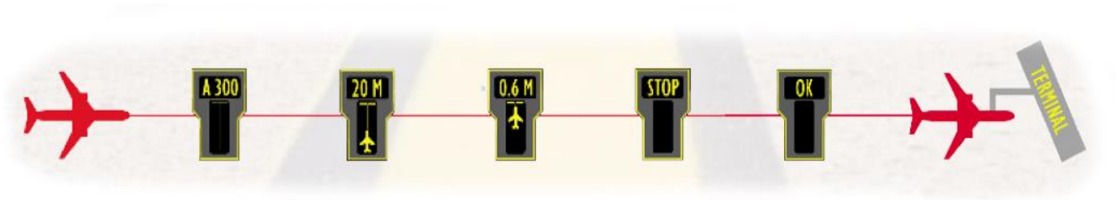

Figure 3 Honeywell parking system

Honeywell A-VDGS is based on electronic imaging technology - a high dynamic range CMOS camera (HDRC). The power of human visual perception lies in its high dynamic range and robust object detection thanks to its high and constant contrast resolution in both bright and dark areas of the scene. HDRC with high dynamic range (up to 170db), high resolution (768x496 pixels), high speed (80ns per pixel) and logarithmic compression per pixel captures maximum content information (MAGIC) with the most efficient use of bits per pixel.

The parking system hosts LAN and VDGS LAN interfaces and centrally manages all local parking positions. It monitors all individual data such as current gateway status, alarms, reports, statistics, flight schedule, and so on. The standard interface allows data communication in terms of occupying gates and obtaining such information, such as aircraft type, expected arrival, etc. In the event of a communication failure, the system may continue to operate in local mode and this means that all flights will then be manually entered [8].

Figure 4 Honeywell detection systems

Key features include real-time gate surveillance using web cameras that are integrated into the system and can also be used for apron monitoring. Signal Control and Monitoring Systems Single Lamp Control and Monitoring System was developed by Honeywell Airport Systems and allows control and monitoring of each light and group of lights within a single circuit without the need for additional communication cables. Thanks to the ability to determine the exact position of the non-functional light, it is possible to monitor the area as recommended by ICAO (Identify the nearby lights) and to facilitate and speed up the service. The lights are controlled by addressable switching units that are connected between a conventional transformer and a light and controlled by signals modulated on the serial current cable.

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3.4. Siemens camera system

This camera system from Siemens includes two CCTV cameras to detect incoming aircraft from the rolling track to the stopping point. The captured images are compared with the 2-D templates of the expected aircraft. According to the information obtained, and by comparing the difference between the image of the scanned aircraft and the 2-D template, the computer calculates the incoming aircraft position throughout the guidance process. The pilot receives the information via the LED display. This display is widescreen with a visibility of about 120 degrees and uses video sensors with four lines and eight characters that contain text just like any other standard RIDS. LEDs are easy to read and are visible even in adverse weather conditions such as rain, fog, snow or bright sunlight. The Gateway Scan feature senses obstacles and only provides the option of boarding bridges if the boarding bridge is correctly positioned [11, 12].

4. CONCLUSION

The principle of the operation of these systems is similar, it depends only on the way of sensing the position of the aircraft, on the way of distinguishing their silhouette and the type and distance from the stop bar and from the aircraft standing axis. An important condition is mutual seamless communication with the used type of boarding bridges and other enhancements that the system adds, such as cameras, transponders, multiple line displays and the like. The goal is to operate a system that can be used at low visibility airport traffic without the need to Follow Me. The requirements for the Aircraft Visual Docking Guidance System is fully compliant with International Civil Aviation Organization (ICAO) requirements, ICAO annex 14 sections 5.3.24 and 5.3.25 [5th Edition July 2009], and Aerodrome Design Manual Document (Doc 9157-AN/901), Part 4, Visual Aids.

Advanced visual docking guidance systems will become a standard for airports and airlines seeking new technology and solutions to increase capacity and improve performance in ground operations during regular and irregular operating conditions. New capabilities are sure to develop as more and more users start to use the value of ramp intelligence technology.

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